UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/594,458	09/26/2006	Hideki Sato	129546	9288

25944 7590 03/11/2009

OLIFF & BERRIDGE, PLC
P.O. BOX 320850
ALEXANDRIA, VA 22320-4850

EXAMINER	
VINH, LAN	
ART UNIT	PAPER NUMBER
1792	
MAIL DATE	DELIVERY MODE
03/11/2009	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/594,458	SATO, HIDEKI	
	Examiner	Art Unit	
	LAN VINH	1792	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *11 February 2009*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *5 and 9* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *5, 9* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 2/11/2009 has been entered.

Response to Arguments

2. The applicants argue that there is no suggestion to combine the references of Engeler/Tiermann/Gantley and Seki because Engeler does not provide any reason or rationale for one of ordinary skill in the art to have modified the etching solution disclosed therein to have the precisely claimed ratio of hydrofluoric acid : nitric acid : acetic acid : water and to also include iodine or iodide in the amounts as claimed at least because Engeler does not disclose, teach or suggest that the etching rate of an etching solution can or should be adjusted in order to accurately evaluate crystal defects of a silicon wafer with low electrical resistivity/Tiemann provides no reason or rationale for one of ordinary skill in the art to have adjusted the volume ratio of an etching solution comprising hydrofluoric acid, nitric acid, acetic acid, and water in the ratio as claimed and further comprising iodine or iodide in the claimed amount to provide an etching solution with an etching rate as claimed/Gantley does not provide

any reason or rationale for one of ordinary skill in the art to have adjusted the concentration of the components and the etching rate of the Gantley etching solution to be within the claimed range form fine patterns and Seki discloses that acetic acid should not be used in an etching solution and Seki does not provide any reason or rationale for one of ordinary skill in the art to have known that increasing the amount of acetic acid in a etching solution would decrease the etching rate of a five-component etching solution.

Theses arguments have been fully considered and are persuasive. Therefore, the rejection(s) of claims 5, 9 under 35 U.S.C 103(a) based on Engeler/Tiermann/Gantley and Seki have been withdrawn. However, upon further consideration, a new ground(s) of rejection of claims 5, 9 under 35 U.S.C 103(a) as being unpatentable over Engeler/Tiermann/Gantley in view of the newly cited reference of Maeno et al (5,714,407) is made since Maeno discloses that increasing the amount of acetic acid in a etching solution would decrease the etching rate of the etching solution (fig. 3) and it is noted that section 2144 of the MPEP states that: "II. OPTIMIZATION OF RANGES

A. Optimization Within Prior Art Conditions or Through Routine Experimentation

Generally, differences in concentration or temperature will not support the patentability of subject matter encompassed by the prior art unless there is evidence indicating such concentration or temperature is critical. "[W]here the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation." In re Aller, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955)

B. Only Result-Effective Variables Can Be Optimized

A particular parameter must first be recognized as a result-effective variable, i.e., a variable which achieves a recognized result, before the determination of the optimum or workable ranges of said variable might be characterized as routine experimentation. In re claim Antonie, 559 F.2d 618, 195 USPQ 6 (CCPA 1977) "

The new ground of rejection(s) follows

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 5, 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Engeler (US 3,558,375) in view of Maeno et al (US 5,714,407)

Engeler discloses a method of fabricating semiconductor structure. The method comprises:

etching a surface of the silicon wafer by immersing the wafer in an etching solution, the etching solution comprises 160 cc acetic acid, iodine, 280 cc nitric and 50 cc HF (col 6, lines 37-40, col 7, lines 21-25), which reads on the etching solution is a mixture of hydrofluoric acid, nitric acid, acetic acid and water further including iodine or iodide, in which a volume ratio of nitric acid in the etching solution is the largest among volume ratios of hydrofluoric acid, nitric acid, acetic acid and water, observing etched patterns on the surface of the wafer (col 6, lines 28-32), which reads on observing etch pits

formed on the etched surface of the wafer, the silicon wafer has electrical resistivity of about 0.05 ohm-cm (col 6, lines 1-5), which reads on the claimed resistivity of 1 ohm-cm or less.

Unlike the instant claimed inventions as per claims 5, 9, Engeler fails to specifically discloses that the etching solution includes hydrofluoric acid : nitric acid : acetic acid : water in a volume ratio of 1 : 13-17 : 4-8 : 4-8 , 0.01 -0.09 g per liter of iodine to decrease the etching rate of the etching solution and a removal amount/etching rate of the surface of the silicon wafer is 50 nm or more/100 nm/min or less

Maeno in a semiconductor manufacturing method, discloses : using an etching solution comprises HF, nitric acid, acetic acid, the concentration of the acids vary (col 11, lines 35-40), the etching solution contains iodine (col 10, lines 10-15), increasing the amount of acetic acid in a etching solution would decrease the etching rate of the etching solution (fig. 3). Thus, Maeno also serves as an evidence that changing the concentration of the elements of the etching solution/parameters according to the material being etched appears to reflect a result- effective variable.

One skilled in the art at the time the invention was made would have found it obvious to vary the concentrations of the acids/increasing the concentration of acetic acid, iodine in Engeler etching solution by conducting routine experimentation in order to decrease the etching rate of the etching solution thus improving the uniformity of etching /to achieve any desirable etching rates including the claimed rates because it is noted that result-effective variable can be optimized MPEP 2144.05 II B.

4. Claims 5, 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tiemann et al (US 3,772,102) in view of Maeno et al (US 5,714,407)

Tiemann discloses a method for transferring a desired pattern in silicon to a substrate layer. The method comprise: etching a surface of the silicon wafer by immersing the wafer in an etching solution, the etching solution comprises 3 parts acetic acid, iodine, 5 parts nitric and 3 parts HF (col 3, lines 59-67; col 4, lines 1-5), which reads on the etching solution is a mixture of hydrofluoric acid, nitric acid, acetic acid and water further including iodine or iodide, in which a volume ratio of nitric acid in the etching solution is the largest among volume ratios of hydrofluoric acid, nitric acid, acetic acid and water, observing etched patterns on the surface of the wafer (col 4, lines 19-25), which reads on observing etch pits formed on the etched surface of the wafer, the silicon wafer is in crystalline form (col 3, lines 25-30), which reads on the silicon wafer has electrical resistivity of 1 ohm.cm or less since the applicants discloses in page 11 of the instant specification that silicon single crystal wafer has electrical resistivity of 0.01-1 ohm.cm. wafer in an etching solution, the etching solution comprises 3 parts acetic acid, iodine, 5 parts nitric and 3 parts HF (col 3, lines 59-67; col 4, lines 1-5), which reads on the etching solution is a mixture of hydrofluoric acid, nitric acid, acetic acid and water further including iodine or iodide, in which a volume ratio of nitric acid in the etching solution is the largest among volume

Unlike the instant claimed inventions as per claims 5, 9, Tiemann fails to specifically discloses that the etching solution includes hydrofluoric acid : nitric acid : acetic acid :

water in a volume ratio of 1 : 13-17 : 4-8 : 4-8 , 0.01 -0.09 g per liter of iodine to decrease the etching rate of the etching solution and a removal amount/etching rate of the surface of the silicon wafer is 50 nm or more/100 nm/min or less

Maeno in a semiconductor manufacturing method, discloses : using an etching solution comprises HF, nitric acid, acetic acid, the concentration of the acids vary (col 11, lines 35-40), the etching solution contains iodine (col 10, lines 10-15), increasing the amount of acetic acid in a etching solution would decrease the etching rate of the etching solution (fig. 3). Thus, Maeno also serves as an evidence that changing the concentration of the elements of the etching solution/parameters according to the material being etched appears to reflect a result- effective variable.

One skilled in the art at the time the invention was made would have found it obvious to vary the concentrations of the acids/increasing the concentration of acetic acid, iodine in Tiemann etching solution by conducting routine experimentation in order to decrease the etching rate of the etching solution thus improving the uniformity of etching /to achieve any desirable etching rates including the claimed rates because it is noted that result-effective variable can be optimized MPEP 2144.05 II B

5. Claims 5, 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gantley (US 3,960,623) in view of Maeno et al (US 5,714,407)

Gantley discloses a semiconductor etching method. The method comprises etching a surface of the silicon wafer by immersing the wafer in an etching solution, the etching solution comprises acetic acid, iodine, nitric and HF (col 3, lines 49-65), which reads on

the etching solution is a mixture of hydrofluoric acid, nitric acid, acetic acid and water further including iodine or iodide, observing etched portions of a semiconductor bodied (col 4, lines 10-14), which reads on observing etch pits formed on the etched surface of the wafer, the silicon wafer is in crystalline form (col 2, lines 50-53), which reads on the silicon wafer has electrical resistivity of 1 ohm.cm or less since the applicants discloses in page 11 of the instant specification that silicon single crystal wafer has electrical resistivity of 0.01-1 ohm.cm

Unlike the instant claimed inventions as per claims 5, 9, Gantley fails to specifically discloses that the etching solution includes hydrofluoric acid : nitric acid : acetic acid : water in a volume ratio of 1 : 13-17 : 4-8 : 4-8 , 0.01 -0.09 g per liter of iodine to decrease the etching rate of the etching solution and a removal amount/etching rate of the surface of the silicon wafer is 50 nm or more/100 nm/min or less

Maeno in a semiconductor manufacturing method, discloses : using an etching solution comprises HF, nitric acid, acetic acid, the concentration of the acids vary (col 11, lines 35-40), the etching solution contains iodine (col 10, lines 10-15), increasing the amount of acetic acid in a etching solution would decrease the etching rate of the etching solution (fig. 3). Thus, Maeno also serves as an evidence that changing the concentration of the elements of the etching solution/parameters according to the material being etched appears to reflect a result- effective variable.

One skilled in the art at the time the invention was made would have found it obvious to vary the concentrations of the acids/increasing the concentration of acetic acid, iodine in Gantley etching solution by conducting routine experimentation in order to decrease the

etching rate of the etching solution thus improving the uniformity of etching /to achieve any desirable etching rates including the claimed rates because it is noted that result-effective variable can be optimized MPEP 2144.05 II B

6. Claims 5, 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Caldwell (US 4,251,300) in view of Maeno et al (US 5,714,407)

Caldwell discloses a semiconductor etching method. The method comprises etching a surface of the silicon wafer 12 having crystal orientation by immersing the wafer in an etching solution, the etching solution comprises acetic acid, iodine, nitric and HF (col 3, lines 5-20), which reads on the etching solution is a mixture of hydrofluoric acid, nitric acid, acetic acid and water further including iodine or iodide, observing etched pits 15 in the surface of the semiconductor wafer (col 3, lines 10-13), which reads on observing etch pits formed on the etched surface of the silicon wafer, the silicon wafer has electrical resistivity of 1 ohm.cm or less since the applicants discloses in page 11 of the instant specification that silicon single crystal wafer has electrical resistivity of 0.01-1 ohm.cm

Unlike the instant claimed inventions as per claims 5, 9, Caldwell fails to specifically discloses that the etching solution includes hydrofluoric acid : nitric acid : acetic acid : water in a volume ratio of 1 : 13-17 : 4-8 : 4-8 , 0.01 -0.09 g per liter of iodine to decrease the etching rate of the etching solution and a removal amount/etching rate of the surface of the silicon wafer is 50 nm or more/100 nm/min or less

Maeno in a semiconductor manufacturing method, discloses : using an etching solution comprises HF, nitric acid, acetic acid, the concentration of the acids vary (col 11, lines 35-40), the etching solution contains iodine (col 10, lines 10-15), increasing the amount of acetic acid in a etching solution would decrease the etching rate of the etching solution (fig. 3). Thus, Maeno also serves as an evidence that changing the concentration of the elements of the etching solution/parameters according to the material being etched appears to reflect a result- effective variable.

One skilled in the art at the time the invention was made would have found it obvious to vary the concentrations of the acids/increasing the concentration of acetic acid, iodine in Caldwell etching solution by conducting routine experimentation in order to decrease the etching rate of the etching solution thus improving the uniformity of etching /to achieve any desirable etching rates including the claimed rates because it is noted that result-effective variable can be optimized MPEP 2144.05 II B

Conclusion

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to LAN VINH whose telephone number is (571)272-1471. The examiner can normally be reached on M-F 8:30-5:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 571 272 1465. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Lan Vinh/
Primary Examiner, Art Unit 1792